REMARKS

Applicant has carefully reviewed the Official Action dated June 14, 2006 for the above identified patent application.

The Examiner's indication at page 6 of the Official Action, that Claims 24, 26 - 28 and 32 - 33 are directed to allowable subject matter, is gratefully acknowledged by Applicant.

At page 2 of the Official Action, the Examiner has objected to this patent application as not including drawings, and has required Applicant to furnish drawings. However, during telephone discussions between the undersigned and Examiner Khuu on June 19 and June 21, 2006, the Examiner acknowledged that four (4) sheets of drawing (Figs. 1 - 4), were, in fact, filed with the original application papers on June 14, 2005. Examiner Khuu advised the undersigned that the Drawing Objection at page 2 of the June 14, 2006 Official Action was withdrawn since drawings were, in fact, on file for this patent application.

At page 2 of the Official Action, the Examiner has raised objections to Claims 1 - 33, as more specifically set forth in the Official Action. The form of the claims has been revised in the present Amendment to correct all basis for the Claim Objections noted by the Examiner in the Official Action.

At page 3 of the Official Action, method Claims 1 - 22 and 30 - 31 have been rejected under 35 U.S.C. Section 101 on the grounds that the claimed subject matter is directed to non-statutory subject matter. Applicant respectfully disagrees with this basis for rejection of the method claims. The form of the method claims has been revised herein such that these claims are clearly directed to statutory subject matter. More specifically, each of the method claims now expressly recites "A method for measuring the position of an object", and thus the claims are directed to a practical and tangible result. (See, for example, page 1, lines 13 - 33 of Applicant's Specification). Thus, the method claims are directed to a practical application in the technological arts in accordance with Section 2106, pages 2100-17 through 2100-18 of The Manual Of Patent Examining Procedure, 8th Edition, (Rev. 4, October 2005). Additionally, the method claims are directed to manipulation of data representing physical objects or activities, in accordance with The Manual of Patent Examining Procedure, page 2100-16, 8th Edition (Rev. 4, October 2005). Simply stated, the specific methods defined by the method claims pending herein, do not preempt an algorithm, and do not cover only an abstract idea. On the contrary, the claims are directed to a practical application in the technical arts and/or the manipulation of data corresponding to signals (e.g., a position signal, a reference signal) which are intangible representations of physical objects or activities, and thus are directed to statutory subject matter. Applicant respectfully requests that the rejection of the method

claims made in the Official Action under 35 U.S.C. Section 101 be reconsidered and withdrawn in view of both the amendment to the form of the method claims and the arguments presented herein.

* * *

In the present Amendment, independent Claim 1 has been revised to include the features of dependent Claims 2 and 3, and dependent Claims 2 and 3 have been cancelled, without prejudice, since the features of these claims are now incorporated in independent Claim 1.

Independent Claim 23 has been amended to include the features of dependent Claim 28 and certain of the features of dependent Claim 26.

New Claims 34 - 55 have been added to this application to claim additional features and/or combination of features of the invention disclosed in the original specification and drawings. New independent Claim 35 includes the features of original Claims 1 and 9; new independent Claim 46 includes the features of original Claims 1 and 22 and additional features of the invention disclosed in the original application and drawings; and new independent Claim 52 includes the features of original Claim 23 in combination with additional features of the invention as disclosed in the original specification and drawings.

For the reasons to be discussed as follows, Applicant respectfully submits that all claims pending in the present application are in condition for allowance.

At pages 3 - 6 of the Official Action, Claims 1 - 6, 9, 17, 19, 21, 23, 25, and 29 have been rejected under 35 U.S.C. Section 102(b) as being anticipated by Hagl et al (U.S. Patent No. 6,097,318). The basis for the prior art rejection of these claims is discussed in the Official Action. Applicant respectfully disagrees with the prior art rejection raised in the Official Action with respect to the claims currently pending in this application.

In the disclosure of the Hagl et al patent, the signal periods of laser interferometers or other inferentially operating optical position measuring systems, have very short signal periods, and correspondingly high signal frequencies due to the high resolution. This results in signals of 2 MHz at relatively slow displacement velocities. Not all evaluation units are capable of processing such high-frequency analog incremental signals (See Col. 1, lines 43 - 63 of the Hagl et al specification).

Consequently, the system and methods according to the Hagl et al disclosure seek to reduce the possibility of too high signal frequency of the analog incremental signals in the case of high-resolution position measuring systems, or in the case of

high relative velocities. For this purpose, a signal period variation unit is provided (See Col. 2, lines 19 - 23 of the Hagl et al specification).

It is important to note that although the Hagl et al specification refers to a "variation" of the signal period, only an increase of the signal period of disclosed (note that the signal period T is the inverse of frequency, f: T = 1/f - an increase in frequency implies a decrease of the signal period). Consequently, the term "variation" as used in the Hagl et al specification refers to "increase of the signal period" or, synonymously, "decrease of frequency". The Hagl et al disclosure does not teach or suggest an increase of frequency.

More specifically, in the Hagl et al patent, the signal period of the outgoing signal is increased by an integer factor. This feature of the Hagl et al disclosure is expressly stated throughout the Hagl et al specification, as for example:

> 1. "A change of the signal period of the analog incremental signal SIN, COS which are transmitted to the evaluation unit 4 can necessary for different reasons. For example, a high-resolution position measuring system provides analog incremental signal SIN, COS with a relatively small signal period, so that high frequency incremental signals are present at the input of the evaluation unit 4. These high frequency incremental signal cannot be further processed by the evaluation unit. In such a case an increase in the signal period, or respectively a reduction in the signal frequency is required. (Column 4, lines 56 - 67 of the Hagl et al specification);
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> 2. "Alternatively, it is also possible that the transmitted

analog incremental signal has very small signal periods, or respectively very high signal frequencies which result in connection with high displacement velocities between the scale graduation 1 and the scanning unit 3. This makes an increase of the signal period, or respectively a decrease of the signal frequency, necessary..." (Col. 5, lines 1 - 7 of the Hagl et al specification);

3. "In the case of a required increase of the signal period, a multiplication of the respective signal period with at least one signal period variation factor (n) is preferably performed. For example, it is also possible to preset several such factors n = 4, 8, 16, by which the signal period of the analog incremental signal SIN, COS is increased..." (Col. 5, lines 12 - 17 of the Hagl specification);

4. "Besides a whole number signal period variation factor (n), it is also possible, for example, in case of an interferometer, to select an appropriate non-whole number variation factor (n)." (Col. 5, lines 19 - 21 of the Hagl et al specification);

5. "...an increase of the signal period SP by the factor n = 4 is provided in the illustration shown..." (Col. 6, lines 36 - 38 of the Hagl et al specification); and

6. "Assuming only a variation of the input signal periods SP by only whole number signal variation factor (n), i.e., SP' = n*SP..." (Col. 8, lines 19 - 21 of the Hagl et al specification).

In summary, there is not a single instance in which the disclosure of the Hagl et al patent refers to a frequency increase, i.e., a shortening of the signal periods.

* * *

Referring now to the claims pending in the present application, independent Claim 1 now incorporates the features of dependent Claims 2 and 3. Applicant respectfully submits that

independent Claim 1 is not anticipated or suggested by the disclosure of Hagl et al for at least the following reasons:

1. The feature in independent Claim 1 that the periods of the input sine and cosine signals are multiples of the periods of the output sine and cosine signals, respectively, is not taught or suggested by Hagl et al;

2. The expression multiple of the signal period in independent Claim 1 refers to an increase of frequency in the output signals with respect to the input signals. This recitation refers to the dictionary definition of the term "multiple" which is defined as "a number which is a product of some specified number and another number [10 is a multiple of 5] New World Dictionary of the American Language; or "the product of a quantity by an integer [35 is a multiple of 7]", The Mirriam Webster Dictionary.

Because the periods of the input signals are greater than the periods of the output signals, a single period of an input signal equals a plurality of periods of an output signal, which is reflected by an increase in frequency of the output signal relative to the frequency of the input signal. Thus the periods of the input signals are multiples of the periods of the output signals.

The specification, at page 6, line 7, has been revised to correspond to the dictionary definition of the term "multiple". This revision is supported by the original disclosure, as for example at page 7, lines 28 - 29, which refers to an increase in frequency of the output signals, which results from the periods of the input signals being multiples of the periods of the output signals, respectively.

Thus, the frequency of the output signals is increased relative to the frequency of the input signals. This feature of the invention is now expressly recited in independent Claim 1. On the contrary, the disclosure of Hagl et al is concerned only with a decrease in frequency.

3. There is no digital position signal which represents a position measured by a position sensor calculated from an input sine signal and an input cosine signal in the disclosure of Hagl et al, as recited in independent Claim 1. On the contrary, the Hagl et al patent discloses conversion of the input sine and the input cosine into two signals, namely, a direction signal RS, which is generated by the direction determination unit 23, and an interpolated digital signal, which is generated by the interpolation unit 29 (See

Fig. 4, and Col. 7, lines 13 - 26 of the Hagl et al patent). Rather than using a single position signal, the Hagl et al patent teaches the use of two signals.

4. Hagl et al does not disclose digital filtering resulting in a resolution of the filtered signal which is higher than that of the unfiltered signal. By this feature recited in independent Claim 1, it is meant that the output signal is represented by a larger number of bits (which results in higher resolution) than the input signal. The Hagl et al patent does not teach or suggest this feature of Applicant's invention as expressly recited in independent Claim 1.

It is also noted that whenever "resolution" is addressed in the Hagl et al specification, it is referring to a physical resolution of the scale (reference numeral 2), and not the internal representation of the numbers within the disclosed measuring system.

For the reasons discussed herein, Applicant submits that Hagl et al does not anticipate (or suggest) the method defined by independent Claim 1, as amended herein, when all features of the claim are considered in the patentability determination.

Independent Claim 23, as amended herein, includes the features of dependent Claim 28 and a feature of dependent Claim 26. The system defined by independent Claim 23, as amended herein, generally corresponds to the method defined by independent Claim 1, as amended herein, and as discussed above. Applicant respectfully submits that independent Claim 23, as amended herein, is not anticipated (or suggested) by Hagl et al

for the same reasons as discussed with respect to independent Claim 1.

Newly added independent method Claim 35 includes the features of original independent method Claim 1 and dependent method Claim 9. The method defined by independent Claim 35 is not anticipated (or suggested) by Hagl et al for the reasons discussed with respect to independent method Claim 1. Among other things, the recitation of the features that the input signal periods are multiples of the output signal periods, and calculating a digital position signal in independent method Claim 35 are not disclosed (or suggested) by the Hagl et al patent. Additionally, the feature that the input sine signal and input cosine signal are error-corrected before the calculation of the position signal is not taught (or suggested) by Hagl et al. Although the Official Action refers to Column 6, lines 62 - 64 of the Hagl et al specification, this portion of the specification is concerned only with general remarks about error-correction. It does not disclose an error-correction made before the calculation of the position signal, as disclosed and claimed by Applicant, since there is no position signal in the Hagl et al patent before generation of the output signals.

As can be seen from Figure 5 of the Hagl et al drawings, and are disclosed at Col. 9, starting at line 5 of the Hagl et al specification, error-correction is accomplished in the system disclosed by the Hagl et al patent by an input counting unit

(25), a transit counting unit (38), and a processor unit (39), which act on the address counting unit (24). They do not act on the input sine signal and the input cosine signal before any position signal is computed. Even if the combined signals RS and DS of the Hagl et al patent are considered to be a position signal, error-correction takes place after the calculation of RS and DS. There is clearly no teaching (or suggestion) in the Hagl et al patent that the error-correction method disclosed therein can also be applied to the input sine signal and the input cosine signal, and not to the address counting unit.

Applicant respectfully submits that independent method Claim 35 is not anticipated (or suggested) by the disclosure of the Hagl et al patent.

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Newly added independent method Claim 46 includes the features of original independent method Claim 1 and original dependent method Claim 22 in addition to the step of "matching the quadrant position of a reference signal relative to the input signals to the output signals".

As discussed in Applicant's specification, the reference signal is an additional signal combining extra information on the location of reference points. By matching the reference signal to the increased number of signal periods in the output signals,

it is guaranteed that the relative position of the reference signal in the input signal is maintained in the output signal. The reference signal usually designates a predetermined position, which is used as a reference, e.g., as a starting point for incrementally determining the position. As recited in the method defined by independent Claim 46, the reference signal accurately represents the reference position also in the output signal.

Contrary to the method defined by independent Claim 46, the disclosure of the Hagl et al patent does not teach (or suggest) any reference signals, let alone the adaptation of reference signals to the multipled signal periods in the output signals.

* * *

Newly added independent system Claim 52 combines original independent system Claim 23 and also includes the feature of "a signal conditioning unit arranged before the calculation unit, said signal conditioning unit adapted to calculate and correct discrepancies from the nominal states of the input sine signal and the input cosine signal". Independent system Claim 52 generally corresponds to independent method Claim 35. Applicant respectfully submits that independent system Claim 52 is not anticipated (or suggested) by the Hagl et al patent for the same reasons discussed above with respect to independent method Claim 35.

It is well established that a rejection of a claim as being anticipated by a prior art reference requires the Patent & Trademark Office to establish a strict identity of invention between the rejected claim and the applied reference. Stated in other words, a rejection of a claim as being anticipated by a prior art reference is inappropriate unless a single applied prior art reference teaches all features of the rejected claim, as arranged in the claim. See, for example, Connell v. Sears, Roebuck & Co., 220 USPQ 183 (Fed. Cir. 1983).

In the instant case, it is clear that there is no strict identity of invention between the Hagl et al patent and any of the independent claims, as amended herein, which were rejected over Hagl et al in the outstanding Official Action. As discussed herein, Hagl et al does not disclose all features expressly recited in each of the currently pending independent claims, and does not teach the arrangement of the features expressly recited in each of the independent claims. Applicant respectfully submits for the numerous reasons discussed herein, that the Hagl et al patent does not anticipate (or suggest) the inventions defined by each of the independent claims currently pending in the present patent application.

Applicant respectfully submits that all pending claims are in proper form for allowance. Additionally, the objection to the

Enclosed is a Petition for a two month extension of time for responding to the outstanding Official Action, together with the required fee for the requested extension of time.

Also enclosed is the fee for the claims added by the present Amendment, which are in excess of the number of claims previously paid for.

Applicant respectfully submits that this application is in proper form for allowance, and favorable action is respectfully requested.

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In a Supplemental Information Disclosure Statement dated June 13, 2006, (prior to the mailing date of the outstanding Official Action dated June 14, 2006), which was received in the Patent & Trademark Office on June 15, 2006 (after the mailing of the outstanding Official Action dated June 14, 2006), Applicant identified DE 198 15 438 and DE 101 38 640 C1, both of which were cited by the European Patent Office during the course of the prosecution of the corresponding European patent application 03788883. The Supplemental Information Disclosure Statement included copies of U.S. Patent Nos. 6,097,318 and 6,265,992, corresponding to DE 198 15 438. U.S. Patent Nos. 6,097,318 and 6,265,992 were formally cited of record in the Official Action dated June 14, 2006.

The Supplemental Information Disclosure Statement also included a copy of published U.S. Patent Appl. US 2005/0052179 A1 which corresponds to DE 101 38 640 C1. Applicant hereby advises the Examiner that published U.S. Patent Appl. US 2005/0052179 A1 recently issued as U.S. Patent No. 7,129,698 on October 31, 2006.

Applicant respectfully requests that each of the references identified in the Supplemental Information Disclosure Statement filed on June 15, 2006, which have not already been formally cited of record in connection with the present patent application, be formally cited as generally illustrating the background state of the art.

Respectfully submitted,

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REPLACEMENT PARAGRAPH
FOR PAGE 6, 1ST PARAGRAPH
OF SPECIFICATION

In the case of the position measurement method according to the invention for signal period multiplication, this object is achieved in that a position signal is calculated from an input sine signal and an input cosine signal, and wherein an output sine signal and an output cosine signal, each having a number of signal periods corresponding to a single ~~which is a multiple of the~~ signal period of the input signals, are emitted as a function of the position signal. In the position measurement system according to the invention, the position signal is calculated in a calculation unit, and the output signals are produced in a signal generation unit.